MULTIMEDIA UNIVERSITY

STUDENT ID NO

MULTIMEDIA UNIVERSITY

FINAL EXAMINATION

TRIMESTER 1, 2022/2023 (TERM ID 2210)

DSN5101 – COMPUTER ARCHITECTURE & ORGANIZATION

(Diploma in Information Technology)

13 FEBRUARY 2023
2.30 p.m. - 4.30 p.m.
(2 Hours)

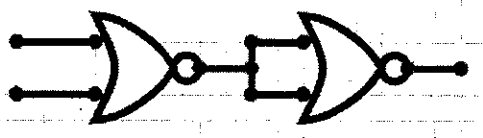
INSTRUCTIONS TO STUDENTS

1. This Question paper consists of 4 pages excluding cover page with 4 Questions only.
2. Answer **ALL** questions. All questions carry equal marks and the distribution of the marks for each question is given.
3. Please write all your answers in the Answer Booklet provided.

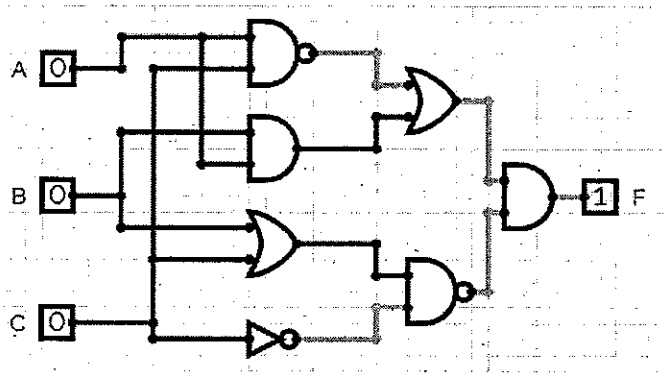
QUESTION 1 (10 marks)

(a) A NAND gate is called a universal gate as it can be used to construct any other logic gates. Draw the NAND equivalent of a NOT gate. [2 marks]

(b) A NOR gate is also called a universal gate. Given the following connection of a NOR gate, what is the equivalent logic gate? Draw the logic symbol. [2 marks]



(c) Given the circuit below



i. Obtain the Boolean expression of F. [1 mark]

ii. Simplify the Boolean expression for F using Boolean Algebra Techniques [3 marks]

iii. Draw the simplified circuit of F. [2 marks]

QUESTION 2 (10 marks)

Design a 3-bit binary parallel counter using T flip-flops so that the decimal counting sequence is 4 – 7 – 3 – 6 and then recycles to 4. All other states should go to 4. Do the following steps in order to complete the design:

Continued...

(a) Draw the state transition diagram showing the sequence in binary form. [1 mark]

(b) Identify the number of flip-flops required and the appropriate excitation table for the design. [1 mark]

(c) Draw the State Table to show the present state, next state, and flip-flop inputs. [3 marks]

(d) Simplify the Boolean expression for each flip-flop input using K-maps. [3 marks]

(e) Draw the circuit diagram of the counter. [2 marks]

QUESTION 3 (10 marks)

(a) Convert the decimal number 13.32_{10} into the following notations:

i. Binary notation (up to 4 binary points) [4 marks]

ii. Octal notation (up to 2 octal points) [2 marks]

iii. Hexadecimal notation (up to 1 hexadecimal point) [2 marks]

(b) State 2 reasons for the usage of hexadecimal notation. [2 marks]

QUESTION 4 (10 marks)

Determine the final output Y of each instruction sets following the types of address instructions and codes. Show the equivalent mathematical notation for each instruction set.

(a) Given A = 24h, B = 4Ah, C = 01h and the following one-address instructions, what is in Y? [3 marks]

Instructions
LOAD A
ADD B
DIV C
STOR Y

Continued...

(b) Given A = FFh, B = 9Bh, C = 02h and the following two-address instructions, what is in Y? [3 marks]

Instructions
MOV Y,A
SUB Y,B
DIV Y,C
ADD Y,B

(c) Given A = 21h, B = 03h, C = AAh and the following three-address instructions, what is in Y? [4 marks]

Instructions
ADD Y,A,B
SUB T,C,A
DIV Y,Y,B
ADD Y,Y,T

Continued...

APPENDIX

Excitation Tables:

S-R Flip-flop

Outputs		Inputs	
Q	Q^+	S	R
0	0	0	X
0	1	1	0
1	0	0	1
1	1	X	0

J-K Flip-flop

Outputs		Inputs	
Q	Q^+	J	K
0	0	0	X
0	1	1	X
1	0	X	1
1	1	X	0

T Flip-flop

Outputs		Inputs
Q	Q^+	T
0	0	0
0	1	1
1	0	1
1	1	0

D Flip-flop

Outputs		Inputs
Q	Q^+	D
0	0	0
0	1	1
1	0	0
1	1	1

End of Page.